TABLE 4.—*Monthly mean heights of freezing temperatures (0° C.) during year 1940, from mean monthly values based on Airplane and Radiosonde observations*

Stations	Elevation in meters (m. s. l.)	January		February		March		April		May		June		July		August		September		October		November		December	
		Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)	Number of observations	Altitude in hundreds of meters (m. s. l.)
Albuquerque, N. Mex.	1,620	31	21	29	24	30	32	30	35	30	42	29	48	13	49	----	----	----	----	----	----	----	----	----	----
Anchorage, Alaska	41	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	27	11	30	(1)	----	(5)
Atlanta, Ga.	300	31	(1)	29	22	31	28	30	33	31	36	29	43	10	43	----	----	----	----	----	----	----	----	----	----
Atlantic Station No. 1 [2]	2	----	----	----	----	----	----	----	----	28	37	30	42	28	45	22	43	23	42	20	32	20	30	26	29
Atlantic Station No. 2 [3]	2	----	----	----	----	----	----	----	----	27	32	30	38	25	42	27	44	27	42	26	37	14	31	14	26
Barrow, Alaska	6	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	15	1	30	(1)	----	(5)	----	(5)
Billings, Mont.	1,089	31	(1)	29	(1)	31	20	28	24	29	33	29	41	14	45	----	----	----	----	----	----	----	----	----	----
Bismarck, N. Dak.	505	31	(1)	29	(1)	31	(1)	30	14	31	30	29	40	13	43	31	44	29	42	31	30	30	(1)	31	(1)
Boise, Idaho	824	31	[4] 10	28	17	31	23	29	26	31	36	29	44	13	47	----	----	----	----	----	----	----	----	----	----
Brownsville, Tex.	6	----	----	----	----	----	----	----	----	----	----	----	----	----	----	27	50	30	49	30	46	26	44	30	39
Buffalo, N. Y.	220	29	(1)	29	(1)	31	(1)	28	11	27	25	29	36	12	32	----	----	----	----	----	----	----	----	----	----
Charleston, S. C.	14	31	13	29	26	31	31	28	34	31	38	30	45	13	45	29	49	30	45	31	37	30	38	30	33
Dayton, Ohio	150	22	(1)	24	(1)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Denver, Colo.	1,616	31	(1)	29	[4] 20	31	27	30	30	31	38	28	46	13	48	29	47	28	45	31	38	30	[4] 25	31	[4] 24
El Paso, Tex.	1,193	31	28	29	30	31	34	30	38	29	42	30	48	13	50	20	49	30	47	31	41	30	35	31	33
Ely, Nev.	1,908	31	(1)	29	(1)	29	26	30	30	31	40	30	46	13	49	31	48	29	40	30	35	30	(1)	31	(1)
Fairbanks, Alaska	153	30	(1)	28	(1)	31	(1)	29	15	31	18	29	25	13	28	----	----	----	----	----	----	----	----	----	(5)
Great Falls, Mont.	1,117	----	----	----	----	----	----	----	----	----	----	----	----	----	----	31	43	30	38	31	29	30	(1)	28	[4] 16
Joliet, Ill.	178	31	(1)	26	(1)	28	(1)	29	19	28	27	28	38	13	39	26	44	29	38	27	31	30	10	31	(1)
Juneau, Alaska	49	31	2	28	1	31	(1)	29	13	30	14	29	18	12	24	----	----	----	----	24	13	24	2	30	5
Ketchikan, Alaska	26	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	27	17	28	8	21	9
Lakehurst, N. J.	39	29	(1)	29	(1)	31	(1)	30	15	31	30	29	39	29	42	30	43	30	35	30	27	30	19	30	14
Medford, Oreg.	401	28	22	28	19	31	23	30	23	31	33	29	44	13	44	18	46	29	34	30	31	30	23	31	23
Miami, Fla.	4	31	37	29	40	31	41	29	43	30	44	29	46	13	47	----	----	----	----	----	----	28	47	30	40
Minneapolis, Minn.	263	31	(1)	29	(1)	31	(1)	29	16	30	26	27	40	12	40	----	----	----	----	----	----	----	----	----	----
Nashville, Tenn.	180	31	(1)	29	14	23	23	30	30	30	34	29	42	12	43	31	47	30	41	31	37	28	28	31	27
Nome, Alaska	14	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	28	(1)	28	(1)	----	(5)
Norfolk, Va.	10	19	(1)	15	12	23	8	27	23	24	31	26	40	25	43	26	43	24	40	22	32	23	25	20	24
Oakland, Calif.	2	31	26	29	24	31	29	30	30	31	37	29	44	13	46	31	47	29	40	31	36	29	32	30	29
Oklahoma City, Okla.	391	30	(1)	29	22	29	29	28	34	31	39	30	45	13	48	31	47	27	44	28	37	29	30	31	30
Omaha, Nebr.	301	31	(1)	29	(1)	31	6	29	25	31	31	30	43	13	45	30	44	29	42	30	35	30	17	31	[4] 17
Pensacola, Fla.	24	28	27	28	29	30	34	27	38	31	40	30	44	30	47	22	45	9	42	23	36	21	37	27	34
Phoenix, Ariz.	339	31	30	29	29	31	34	30	36	30	43	30	49	13	53	31	51	29	47	30	40	28	35	30	33
Portland, Me.	19	----	----	----	----	----	----	----	----	----	----	30	35	12	32	----	----	----	----	----	----	28	8	31	(1)
St. Louis, Mo.	171	31	(1)	29	(1)	31	17	30	27	31	32	30	44	13	45	----	----	----	----	----	----	----	----	----	----
San Antonio, Tex.	174	31	30	29	33	31	37	30	42	31	43	29	47	12	48	----	----	----	----	----	----	----	----	----	----
San Diego, Calif.	19	29	32	28	29	28	33	29	35	29	42	26	47	30	47	12	49	11	45	31	42	30	36	28	34
Sault Ste. Marie, Mich.	221	31	(1)	29	(1)	31	(1)	30	6	31	22	30	31	13	29	30	37	28	31	31	17	30	(1)	31	(1)
Seattle, Wash.	10	22	17	26	14	23	15	24	19	27	28	24	35	20	34	31	39	21	33	27	25	26	16	31	17
Shreveport, La.	51	25	5	18	29	17	29	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Spokane, Wash.	598	31	(1)	29	11	31	18	30	21	30	29	29	38	11	42	----	----	----	----	----	----	----	----	14	18
Swan Island, W. I.	10	----	----	----	----	----	----	----	----	----	----	----	----	----	----	29	50	28	50	----	----	(5)	30	48	----
Washington, D. C.	7	27	(1)	28	7	31	6	29	21	31	31	30	40	30	43	18	45	20	37	30	30	29	22	30	23

[1] Surface.
[2] In or near the 5° square: Lat. 35°00′ N. to 40°00′ N.; long.: 55°00′ W. to 60°00′ W.
[3] In or near the 5° square: Prior to Nov. 14, 1940, lat. 40°00′ N. to 45°00′ N., long. 40°00′ W. to 45°00′ W. Subsequent to Nov. 13, 1940, lat. 35°00′ N. to 40°00′ N., long. 45°00′ W. to 50°00′ W.
[4] Mean monthly temperature at surface was 0° C. or lower, above which was an inversion with mean temperatures above freezing.
[5] Data not yet received.

Airplane observations were received from Pearl Harbor, T. H., throughout the year and from Coco Solo and St. Thomas for several months, but the level of average freezing was not reached at these stations.

RIVER STAGES AND FLOODS

By BENNETT SWENSON

Precipitation during December 1940 was well above normal in the Gulf States and from Missouri, Oklahoma, and Texas, westward to the Pacific coast. Frequent rains, heavy at times, in Mississippi and eastern Texas resulted in protracted high-river stages and moderate flooding. In eastern Texas this was the second consecutive month with abnormally heavy precipitation and flooding. In California, although the first half of the month was dry, excessive rainfall during the latter half brought the state average to 9 inches, nearly 2½ times the normal and the greatest for this month since 1894.

Atlantic slope drainage.—Moderate to heavy rains for 4 days, beginning with December 26, over the upper Susquehanna Basin, caused rising stages with some slight flooding in this area.

East Gulf of Mexico drainage.—Frequent rains over the Pearl River basin during the month, being heavy from the 12th to the 16th, resulted in flood stages beginning on the 16th and continuing into the next month. There were two principal rises; Jackson, Miss., cresting at 24.4 feet on the 23d and at 25.2 feet on the 29th, while Pearl River, La., reached a stage of 15.0 feet on the 21st and after subsiding slightly the stages again rose near the end of the month.

Red Basin.—The Sulphur River was in flood at the beginning of the mouth, the crest of the rise being 27.4 feet on November 29 at Naples, Tex. Two other rises occurred during December and stages of 27.1 and 27.4 feet were reached on December 20 and January 1, respectively. Losses have been estimated at $6,000.

West Gulf of Mexico drainage.—Following moderate to heavy floods in eastern Texas during November (see previous issue of REVIEW) flood stages, or high stages again prevailed during December. These were due to frequent rains, heavy at times, during the month.

At Dallas, the Trinity River exceeded flood stage on three separate occasions during November and December. However, levees protected the city and since there were no growing crops at this time of the year the property loss was slight. The three crests at Dallas were as follows: 32.4 feet on November 26, 33.5 feet on December 16, and 33.2 feet on December 28.

There were two overflows at Trinidad, Tex., the first one extending from November 24 to December 25, with a crest stage of 35.6 feet on November 27, and the second

extending from December 17 to the second week in January with a crest stage of 36.5 feet on December 24. No losses have been reported in this area and property (mostly livestock) valued at $11,000 was protected by removal to higher ground.

Heavy rains over the upper watershed of the Guadalupe River from December 12 to 15 resulted in moderate flood conditions from Gonzales, Tex., to below Victoria, Tex., from the 13th to the 23d. There was no known damage and property (mostly livestock) valued at $5,000 was saved by warnings.

Sacramento Basin.—Following a dry period during November and the first half of December, the latter half of December brought excessive precipitation to the Central Valley of California. High stages resulted in most of the streams of the Sacramento system.

At Fresno, Calif., in the San Joaquin watershed, the total rainfall (5.35 inches), all of which fell in the latter half of the month, was the greatest December total of record. Despite the heavy amounts of precipitation which were concentrated during this period over the basin, the stages in the San Joaquin were high but did not reach flood stage because of the even distribution of run-off.

The official in charge, Sacramento, Calif., reports as follows relative to flood conditions in the Sacramento River:

During November and the first half of December there was one of the longest rainless periods of record for the season. On December 17, however, began a series of storms, recurring at frequent intervals during the remainder of the month. During this period recurring flood waves developed over the upper Sacramento Valley. The first one, occurring on the 18th, was of moderate intensity, but it filled the river channels and covered some bypass lands in advance of the main flood conditions which began to form on the 23d.

Remarkably heavy rainfall amounts were reported over the northern Sacramento River drainage area on the morning of the 18th, the 24-hour amounts at Kennett and Vollmers, in the canyon of the Sacramento River, being 5.70 and 8.10 inches, respectively. With incessant rains continuing, river stages in the Sacramento River during the next several days steadily increased until the actual flood stage of 23 feet at Red Bluff, Calif., was exceeded on December 24, with a crest of 24.8 feet. Timely warnings were issued well in advance of the first major rise and it is believed was an important factor in preventing losses to stockmen and others having property in the low lands in Tehama County and along the river southward throughout all the areas subject to overflow.

On the morning of the 25th, the river at Knights Landing, Calif., aided by a moderate rise in the Feather River, had reached the danger stage of 30 feet, whence it continued to rise to a crest of 31.4 feet on the 28th. In that vicinity the Fremont Weir began to discharge heavily into Yolo bypass on the 25th, reaching a maximum overflow depth of 3.7 feet on the 28th. As a result of this overflow, together with heavy local drainage, particularly that of Cache and Putah Creeks, the flooding of the so-called tidal reclamation districts in the Yolo bypass occurred. These were: Little Holland tract, comprising about 2,700 acres of mostly grain land, flooded late on the evening of the 25th; Prospect Island, containing about 2,500 acres, flooded on the morning of the 26th; and Liberty Island with about 5,000 acres, inundated early a. m. on the 27th. The Lisbon river gage in the Yolo bypass read 17.5 feet at 7 a. m., 26th, and at 4 p. m. it was 18.0 feet. The Liberty Island gage was 14.2 feet at 1 a. m., 27th.

Additional excessive rains occurred during the night of the 26th–27th, causing a secondary rise to begin in the upper courses of the Sacramento River and its tributaries. This rise was more pronounced in the Feather-Yuba and American Rivers, which streams, especially the latter, began to rise rapidly for the first time this season. In the upper Sacramento River the crest at Red Bluff was 23.9 feet on the 27th. By 5 p. m. of the 27th, the rapidly rising American River necessitated the closing of the gates to the flood-control levee on Highway 40 at North Sacramento.

Shortly after midnight of the 27th–28th, 3 of the 48 gates of the Sacramento Weir broke loose, permitting a flow of about 4,500 second feet into the Sacramento bypass. This additional diversion of water from the main river channel no doubt hastened the cresting of the river at Sacramento, which occurred at 4 a. m., December 28, with a stage of 27.27 feet.

At Sacramento the total rainfall during the 15-day period, December 16–30, totaled 9.40 inches, which amount not only constitutes the greatest 15-day total of record for the station, but also is the greatest rainfall for any entire month of December since 1884; likewise it is the greatest monthly amount for all months of the year back to 1911. The total rainfall at Kennett for the 15-day period was 31.77 inches.

As the water was safely confined to the channels in the leveed sections along the river, the flooded areas in the valley were limited to the lowlands that are normally subject to overflow at moderate to high stages. Since these lands were not planted to crops at this season of the year, the damage caused by overflow was comparatively small. Livestock had been removed from affected areas to higher ground.

Heavier losses, however, were sustained in the Yolo bypass from the flooding of Little Holland tract, and particularly Prospect and Liberty Islands, which are more intensely cultivated; also considerable damage was caused to the levees of these islands.

The aggregate money losses occasioned by the flood have been estimated at $178,500, of which $135,000 constituted the prospective crop loss.

A mild flood occurred in the Eel River on the 24th–25th. The crest stage at Fernbridge, Calif., has been estimated at 19 feet. Losses from this flood amounting to $23,000 have been reported.

FLOOD-STAGE REPORT FOR DECEMBER 1940

[All dates in December unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE					
	Feet			*Feet*	
Tioughnioga: Whitney Point, N. Y.	12	28	31	13.9	28
Chenango:					
Sherburne, N. Y.	8	28	31	8.9	29
Greene, N. Y.	8	29	31	9.6	30
Susquehanna:					
Oneonta, N. Y.	12	29	(1)	14.4	30
Bainbridge, N. Y.	12	30	31	12.4	30
Vestal, N. Y.	14	29	(1)	17.45	30
James: Columbia, Va.	10	29	(1)	12.5	30
Saluda: Pelzer, S. C.	6	29	29	6.0	29
Santee: Rimini, S. C.	12	28	30	12.8	29
EAST GULF OF MEXICO DRAINAGE					
Bogue Chitto: Franklinton, La.	11	17	17	11.2	17
Pearl:					
Jackson, Miss.	18	15	(1)	24.4	23
				25.2	29
Monticello, Miss.	15	16	20	16.6	17
		27	(1)	18.2	28
Columbia, Miss.	17	28	(1)	18.0	30
Pearl River, La.	12	16	(1)	15.0	21
MISSISSIPPI SYSTEM					
Red Basin					
Little: White Cliffs, Ark.	25	18	18	25.9	18
Sulphur:					
Ringo Crossing, Tex.	18	12	22	27.3	16
		26	(1)	27.5	27
Naples, Tex.	22	(2)	6	(2)	
		18	27	27.1	20
		29	Jan. 6	27.4	Jan. 1
Lower Mississippi Basin					
Coldwater: Coldwater, Miss.	13	15	19	13.7	18
WEST GULF OF MEXICO DRAINAGE					
Sabine:					
Logansport, La.	25	(2)	(1)	32.5	1
Bon Wier, Tex.	21	2	21	22.5	14
		30	(1)		
Orange, Tex.	4	13	22	4.9	17–18
Neches:					
Rockland (near) Tex.	22	(2)	6	(2)	
		13	20	25.3	16
Beaumont, Tex.	7	14	22	8.8	17
Elm Fork, Trinity: Carrollton, Tex.	7	16	16	7.6	16
Trinity:					
Dallas, Tex.	28	14	18	33.5	16
		27	29	33.25	28
Trinidad, Tex.	28	(2)	5	(2)	
		17	(1)	36.5	24
Long Lake, Tex.	40	(2)	6	(2)	
		27	(1)		
Riverside, Tex.	40	13	13	40.0	13
Liberty, Tex.	24	(2)	(1)	27.1	16, 17, 18

See footnotes at end of table.

FLOOD-STAGE REPORT FOR DECEMBER 1940—Continued

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
	Feet			*Feet*	
Brazos:					
Hempstead, Tex	40	(2)	2	44.1	Nov. 30
Richmond, Tex	35	(2)	4	(3)	
Guadalupe:					
Gonzales, Tex	20	13	14	22.2	13
		16	18	29.0	17
Victoria, Tex	21	14	22	27.4	21
PACIFIC SLOPE DRAINAGE					
Eel: Fernbridge, Calif	18	24	25	19.0	24
Sacramento Basin					
Sacramento: Red Bluff, Calif	23	24	24	24.8	24
		27	27	23.9	27
Knight's Landing, Calif	30	25	31	31.4	28
Columbia Basin					
Long Tom: Monroe, Oreg	10	21	25	11.7	23
		27	30	11.3	29

[1] Continued at end of month.
[2] Continued from preceding month.
[3] Crest occurred previous month.
[4] Highest stage during the month.

WEATHER ON THE NORTH ATLANTIC OCEAN

By H. C. HUNTER

Atmospheric pressure.—For most of the portion of the North Atlantic Ocean that is covered by reports received the pressure during December 1940 averaged higher than normal. This was notably the case for the southeastern part, where the land station at Lisbon, Portugal, shows departure of 8.1 millibars (0.24 inch). For nearly all of the southwestern part, however, particularly the northern Gulf of Mexico, pressure averaged less than normal.

The first half of the month was marked by somewhat higher pressure than the second half over substantially all the North Altantic areas studied.

The pressure extremes found in available vessel reports were 1043.7 and 984.1 millibars (30.82 and 29.06 inches). The high mark was noted during the forenoon of the 5th by the Portuguese steamship *San Miguel*, near 38° N., 35° W. In a not very distant part of the ocean, 39° N., 45° W., the lowest reading was taken at 2 p. m. of the 26th on the U. S. S. *Tuscaloosa*. The latter reading was unusually low for this portion of the North Atlantic, which is not remote from the normal location of the Azores HIGH.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Atlantic Ocean and its shores, December 1940*

Station	Average pressure	Departure from normal	Highest	Date	Lowest	Date
	Millibars	*Millibars*	*Millibars*		*Millibars*	
Lisbon, Portugal	1,027.7	+8.1	1,035	5, 28	1,010	21
Horta, Azores	1,022.3	+1.6	1,041	5	1,000	25
Belle Isle, Newfoundland	1,007.5	+0.4	1,030	5	989	2
Halifax, Nova Scotia	1,017.6	+3.4	1,035	19	1,001	29
Nantucket	1,019.0	+1.4	1,037	19	998	29
Hatteras	1,020.3	0.0	1,033	18	999	29
Turks Island	1,016.5	−0.4	1,020	18, 19	1,011	26, 27
Key West	1,016.3	−2.3	1,025	4	1,000	26
New Orleans	1,017.6	−2.7	1,030	17	989	26

NOTE.—All data based on available observations, departures compiled from best available normals related to time of observation, except Hatteras, Key West, Nantucket, and New Orleans, which are 24-hour corrected means.

A few hours after the *Tuscaloosa's* reading, during the early evening of the 26th, pressure readings which similarly were very low for a winter month and for the region of occurrence were noted over the northwestern Gulf of Mexico, the lowest of these vessel readings at hand being 989.2 millibars (29.21 inches) from the American S. S. *Arizona*, when about 60 miles to southward of the southeast coast of Louisiana.

Cyclones and gales.—The reports that have arrived fail to indicate any important storm over the North Atlantic during the first fortnight. While the remainder of the month was somewhat more turbulent, yet it apparently was less so than December usually is.

The main North Atlantic has furnished six reports of whole gales encountered by vessels, as shown in the accompanying table, and two other reports have come from Gulf of Mexico waters.

A well-developed LOW system, extending far from north to south, moved eastward from North America onto the Atlantic during the 20th and 21st. During the 22d and the early hours of the 23d the southern part of the system was sharply developed, and near the 40th parallel, as it advanced from about 60° to 43° west longitude it caused force 10 winds, as reported by the Coast Guard cutters *Champlain* and *Bibb* and a force 9 wind, as reported by the cutter *Spencer*.

The morning of the 26th found a strong LOW near the northeast coast of Texas, whence it advanced eastward and northeastward to Georgia and then northward. Unusually strong winds resulted over much of the Gulf of Mexico; the American M. S. *J. A. Moffett, Jr.*, in the extreme western part of the gulf and the American S. S. *Agwistar*, hove to off Progreso, had whole gales during the 26th or 27th.

A press dispatch states that in the town of Becujal, western Cuba, "10 persons were killed and 150 injured by freakish gale winds." It seems possible that this havoc resulted from a tornado within the southeast quadrant of the low-pressure area. Another report is to the effect that in the state of Vera Cruz, Mexico, there were 9 dead and many injured, because of high winds, presumably of the general circulation connected with the LOW and the marked HIGH which followed it.

Fog.—Over most North Atlantic waters, as far as reports indicate, fog was once more of very rare occurrence during the first half of the month, but somewhat more frequent from the 16th onward, notably during the final 8 days. While more was reported than during the preceding month, especially from the northwestern Gulf of Mexico and waters to eastward of the Middle Atlantic and New England States, yet there are few areas where there seems to have been more fogginess than in an average December.

The 5°-square, 40° to 45° N., 70° to 75° W., furnished reports of fog on 7 days, the greatest number indicated by any square. Two squares adjoining it had fog on 5 days each, as did also one square in the northwestern Gulf of Mexico, namely 25° to 30° N., 90° to 95° W.

No report has come of fog occurring anywhere to eastward of the 50th meridian.

Several accidents near New York resulted from foggy weather. On the 12th the steamers *Berkshire* and *Charles L. O'Connor* collided outside Sandy Hook, but each, though damaged, was able to make port unassisted. On the 29th a less serious collision in East River and a grounding in the harbor were blamed on fog.